

CLAIMS:

What is claimed is:

5 1. A plant punch apparatus, comprising:

- a first plant punch element that comprises a first plant punch head;
- a plant punch element movement mechanism that is operable to move said first
10 plant punch element through a plurality of spatial points that defines a first
plant punch element travel path; and
- a frame that supports said plant punch movement mechanism,

wherein said plurality of spatial points comprises a first spatial point having a first
horizontal distance from a vertical spatial axis defined by a first plant emergent point,

15 wherein said first plant emergent point is defined by a site at which a first plant
emerges from plant growth media in which it is established before it is punched from
its container during a plant punch event,

20 wherein said first plant emergent point defines a plant emergent point horizontal plane,

wherein said plurality of spatial points further comprises a second spatial point that:

- defines a second horizontal plane that is below said first spatial point
25 and above said plant emergent point horizontal plane, and
- has a second horizontal distance from said vertical spatial axis; and

wherein said first horizontal distance is greater than said second horizontal distance,

30 wherein said first plant punch element travel path intersects and passes through and
below said plant emergent point horizontal plane,

wherein said first plant punch element travel path has a vertical component at its intersection with said plant emergent point horizontal plane, and

5 wherein said first plant punch element travel path has a horizontal component at some point from said first spatial point to said second spatial point of said first plant punch element travel path.

2. A plant punch apparatus as described in claim 1 wherein said plant punch element
10 movement mechanism is operable to move said first plant punch element to generate a plant punch cycle.

3. A plant punch apparatus as described in claim 2 wherein said plant punch element
15 movement mechanism comprises a horizontal plant punch movement mechanism and a vertical plant punch movement mechanism.

4. A plant punch apparatus as described in claim 3 wherein said vertical plant punch movement mechanism is manually operable.

20 5. A plant punch apparatus as described in claim 3 wherein said horizontal plant punch movement mechanism is automatically operable.

6. A plant punch apparatus as described in claim 2 wherein said plant punch element
25 movement mechanism is manually operable.

7. A plant punch apparatus as described in claim 2 wherein said plant punch element movement mechanism is manually operable only in part.

8. A plant punch apparatus as described in claim 2 wherein said plant punch element
30 movement mechanism is automatically operable.

9. A plant punch apparatus as described in claim 2 wherein said plant punch element movement mechanism is automatically operable only in part.
10. A plant punch apparatus as described in claim 1 wherein said first plant punch element travel path passes below said plant emergent point horizontal plane substantially at least by that amount necessary to punch said plant from said container.
11. A plant punch apparatus as described in claim 10 wherein said first plant punch element travel path passes below said plant emergent point horizontal plane at least by that amount necessary to transplant said first plant into a container established below said plant emergent point horizontal plane.
12. A plant punch apparatus as described in claim 1 further comprising additional plant punch elements that each comprise a plant punch head, wherein said plant punch element movement mechanism is also operable to move said additional plant punch elements through additional, respective plant punch element travel paths to punch additional, respective plants, wherein said additional, respective plant punch element travel paths are each spatially oriented relative to their additional, respective plant as said first plant punch element travel path is spatially oriented relative to said first plant, but also wherein said additional, respective plant punch element travel paths are horizontally offset from said first plant punch element travel path.
13. A plant punch apparatus as described in claim 12 wherein said first plant punch element and said additional plant punch elements are established in a row by column pattern.
14. A plant punch apparatus as described in claim 1 further comprising said first plant.
15. A plant punch apparatus as described in claim 14 further comprising additional plants that are punched by additional plant punch elements.

16. A plant punch apparatus as described in claim 1 further comprising additional plant punch elements, wherein said plant punch element movement mechanism is also operable to move said additional plant punch elements through additional, respective plant punch element travel paths that mimic said first plant punch element travel path in parallel fashion.
17. A plant punch apparatus as described in claim 16 wherein said first plant punch element and said additional plant punch elements are established in a row by column pattern.
18. A plant punch apparatus as described in claim 1 further comprising a n^{th} plant punch element that said plant punch element movement mechanism is operable to move through a plurality of spatial points that defines a n^{th} plant punch element travel path.
19. A plant punch apparatus as described in claim 18 wherein said n^{th} plant punch element travel path is horizontally offset from said first plant punch element travel path.
20. A plant punch apparatus as described in claim 19 wherein respective points on each said first plant punch element travel path and said n^{th} plant punch element travel path are horizontally equidistant from each other.
21. A plant punch apparatus as described in claim 1 wherein said plurality of spatial points comprises a third spatial point that is substantially co-incident with said plant emergent point.
22. A plant punch apparatus as described in claim 1 wherein said first plant punch element travel path is substantially vertical when it passes through said lower horizontal plane.
23. A plant punch apparatus as described in claim 1 wherein said first spatial point, said second spatial point and said first plant emergent point are substantially within the same vertical plane.

24. A plant punch apparatus as described in claim 1 wherein an upper portion of said first plant punch element travel path that is between said first spatial point and said second spatial point of said first plant punch element travel path is substantially vertical.

25. A plant punch apparatus as described in claim 1 wherein said plant punch element travels along said first plant punch element travel path from said first spatial point of said first plant punch element travel path, then through said second spatial point of said first plant punch element travel path, then through said plant emergent point horizontal plane.

26. A plant punch apparatus as described in claim 1 wherein, after traveling through said plant emergent point horizontal plane, said first plant punch element reaches a lowest position, and then returns to said first spatial point of said first plant punch element travel path through a first plant punch element return travel path that is part of said first plant punch element travel path.

27. A plant punch apparatus as described in claim 26 wherein said first plant punch element return travel path comprises said second spatial point and said first spatial point of said first plant punch element travel path.

28. A plant punch apparatus as described in claim 26 wherein at least half of said first plant punch element return travel path is along said vertical spatial axis.

29. A plant punch apparatus as described in claim 1 wherein said first plant punch element reaches its highest point at said first spatial point of said first plant punch element travel path.

30. A plant punch apparatus as described in claim 1 wherein said plant punch movement mechanism is operable to move said first plant punch element through said horizontal component of said first plant punch element travel path through pneumatics.

31. A plant punch apparatus as described in claim 1 wherein said plant punch movement mechanism is operable to move said first plant punch element through said vertical component of said first plant punch element travel path upon application of a manual force to said plant punch movement mechanism.

32. A plant punch apparatus as described in claim 1 wherein said first plant punch element further comprises a first plant punch body.

33. A plant punch apparatus as described in claim 1 wherein an upper portion of said first plant has plant punch sensitive vegetative parts that define a sensitive vegetation profile in a plane defined by said first spatial point and said plant emergent point, and wherein said first plant punch element travel path is outside one side of said sensitive vegetation profile.

34. A plant punch apparatus as described in claim 1 wherein said first plant punch element initiates a horizontal motion at a horizontal motion initiation point located at some point between said first spatial point and said second spatial point and along said first plant punch element travel path.

35. A plant punch apparatus as described in claim 34 wherein said horizontal motion initiation point has a horizontal motion initiation height above said plant emergent point horizontal plane, and wherein said horizontal motion initiation height is adjustable.

36. A plant punch apparatus as described in claim 34 wherein said horizontal motion initiation point has a horizontal motion initiation width that is equal to a horizontal distance of said horizontal motion initiation point from said vertical spatial axis, and wherein said horizontal motion initiation width is adjustable.

37. A plant punch apparatus as described in claim 1 wherein said horizontal component of said first plant punch element has a horizontal motion initiation point between said first spatial point and said second spatial point, and wherein said horizontal motion initiation point is spatially adjustable.

5

38. A plant punch apparatus as described in claim 1 wherein said plant punch element movement mechanism is operable to effect a horizontal travel distance of said first plant punch element, and wherein said horizontal travel distance is adjustable.

10 39. A plant punch method, comprising the steps of:

- moving a first plant punch element having a first plant punch head, from a first spatial point to a second spatial point that is lower than said first spatial point, wherein said first spatial point and said second spatial point partially define a first plant punch element travel path;

15

wherein said first spatial point has a first horizontal distance from a vertical spatial axis that defines a first plant emergent point,

20 wherein said first plant emergent point is defined by the site at which a first plant emerges from plant growth media in which it is established before it is punched from its container during a plant punch event,

25

wherein said second spatial point has a second horizontal distance from said vertical spatial axis, and

wherein said first horizontal distance is greater than said second horizontal distance,

and further comprising the steps of:

30

- moving said first plant punch element through a plant emergent point horizontal plane defined by said first plant emergent point so as to punch said first plant from its container;
- punching said first plant from its container;
- 5 - reaching a lowest first plant punch element position; and
- returning said first plant punch element to said first spatial point.

40. A plant punch method as described in claim 39 further comprising the step of transplanting said first plant.

10

41. A plant punch method as described in claim 39 wherein said step of returning said first plant punch element to said first spatial point comprises the step of completing a plant punch cycle.

15 42. A plant punch method as described in claim 39 wherein said step of moving said first plant punch element through a horizontal plane defined by said first plant emergent point so as to punch said first plant from its container comprises the step of manually moving said plant punch element through use of a plant punch movement mechanism.

20 43. A plant punch method as described in claim 39 wherein said step of moving a first plant punch element from a first spatial point to a second spatial point comprises the step of moving said first plant punch element to have a horizontal component of motion.

25 44. A plant punch method as described in claim 43 wherein herein said step of moving said first plant punch element to have a horizontal component of motion comprises the step of pneumatically moving said first plant punch element through use of a plant punch movement mechanism.

30 45. A plant punch method as described in claim 43 wherein said step of moving said first plant punch element to have a horizontal component of motion comprises the step of

automatically moving said first plant punch element through use of a plant punch movement mechanism.

46. A plant punch method as described in claim 39 wherein said step of returning said first
5 plant punch element to said first spatial point comprises the step of returning said plant punch element to said first spatial point only after returning said first plant punch element to said second spatial point.
47. A plant punch method as described in claim 39 wherein said step of returning said first
10 plant punch element to said first spatial point comprises the step of vertically moving said first plant punch element such that substantially at least one third of its travel from said lowest first plant punch element position to said first spatial point is along said vertical spatial axis.
48. A plant punch method as described in claim 47 wherein said step of vertically moving
15 said first plant punch element such that substantially at least one third of its travel from said lowest first plant punch element position to said first spatial point is along said vertical spatial axis is performed manually.
49. A plant punch method as described in claim 39 wherein said step of moving said first
20 plant punch element through a plant emergent point horizontal plane defined by said first plant emergent point comprises the step of moving said first plant punch element substantially through said first plant emergent point.
50. A plant punch method as described in claim 39 wherein said step of moving said first
25 plant punch element through a plant emergent point horizontal plane comprises the step of purely vertically moving said first plant punch element.
51. A plant punch method as described in claim 39 wherein said step of moving a first
30 plant punch element from a first spatial point to a second spatial point comprises the

step of moving said plant punch element from its highest position during a punch cycle.

52. A plant punch method as described in claim 39 wherein said step of moving a first
5 plant punch element from a first spatial point to a second spatial point that is lower than said first spatial point comprises the step of moving said first plant punch element horizontally while also moving said first plant punch element vertically downward.

53. A plant punch method as described in claim 52 wherein said step of moving said first
10 plant punch element horizontally comprises the step of pneumatically moving said first plant punch element.

54. A plant punch method as described in claim 52 wherein said step of moving said first
15 plant punch element vertically downward comprises the step of manually moving said first plant punch element.

55. A plant punch method as described in claim 39 wherein said step of moving a first
20 plant punch element from a first spatial point to a second spatial point that is lower than said first spatial point comprises the step of moving said first plant punch element outside of one side of a sensitive vegetation profile defined by sensitive vegetative parts of an upper portion of said first plant, wherein said sensitive vegetation profile is in a plane defined by said first spatial point and said plant emergent point.

56. A plant punch method as described in claim 39 further comprising the step of moving
25 at least one additional plant punch element through a respective at least one additional plant punch element travel path that is each horizontally offset from said first plant punch element travel path.

57. A plant punch method as described in claim 56 wherein said plant punch element
30 further comprises a plant punch body.

58. A plant punch method as described in claim 39 wherein said step of moving a first plant punch element from a first spatial point to a second spatial point comprises the step of initiating a horizontal motion of said first plant punch element at a horizontal motion initiation point.

5

59. A plant punch method as described in claim 58 wherein the step of initiating a horizontal motion of said first plant punch element comprises initiating said horizontal motion at a horizontal motion initiation height above said plant emergent point horizontal plane, and further comprises the step of adjusting said horizontal motion initiation height.

10

60. A plant punch method as described in claim 58 wherein the step of initiating a horizontal motion of said first plant punch element comprises initiating said horizontal motion at a horizontal motion initiation width that is equal to a horizontal distance of said horizontal motion initiation point from said vertical spatial axis, and further comprises the step of adjusting said horizontal motion initiation width.

15

61. A plant punch method as described in claim 39 wherein said step of moving said first plant punch element through a plant emergent point horizontal plane defined by said first plant emergent point so as to punch said first plant from its container comprises the step of moving said first plant punch element through a plant emergent point horizontal plane substantially at said first plant emergent point.

20

62. A plant punch method, comprising:

- moving a plant punch element that comprises a plant punch head downwards from a first position;
- moving said plant punch head in towards a vertical spatial axis defined by a first plant emergent point,

wherein said first plant emergent point is defined by the site at which a plant emerges from plant growth media in which it is established before it is punched from its container during a plant punch event,

- punching said plant with said plant punch element to cause a plant punch event; and
- returning said plant punch element to said first position.

63. A plant punch method, comprising:

- a) establishing a plant punch element that comprises a plant punch head, in a first position that is outside of a sensitive vegetation profile defined by plant punch sensitive vegetative parts of an upper portion of a first plant,
- b) moving said plant punch element to have a downward component of motion while maintaining said plant punch head outside of said sensitive vegetation profile
- c) moving said plant punch head to a point below said sensitive vegetation profile;
- d) moving said plant punch head inwardly towards a central stem that supports said plant punch sensitive vegetative parts;
- e) punching said plant with said plant punch element; and
- f) returning said plant punch head to said first position.

64. A plant punch apparatus, comprising:

- a plant punch head comprising:

- a downward plant punch force application surface that is adapted so that:

- during a plant punch event, and

- while said plant punch head is displaced downwardly against plant growth medium in which a plant to be punched during said plant punch event is established, and

- while said downward plant punch force application surface is positioned horizontally about a plant growth medium emerging plant structure,

- said downward plant punch force application surface displaces said plant without contacting said plant growth medium emerging plant structure,

wherein said downward plant punch force application surface has a horizontal cross section shape and size, and

wherein said plant growth medium emerging plant structure is that vegetative structure of said plant that emerges from said plant growth medium and supports upper vegetative portions of said plant,

and further comprising:

a plant punch body established above said plant punch head, and

wherein said plant punch body is adapted so that, while said plant punch head is displaced downwardly against plant growth medium in which said plant to be punched during said plant punch event is established, said plant punch body is at least partly around at least a one-third of height portion of said plant.

65. A plant punch apparatus as described in claim 64 wherein said plant punch body is at least partly around at least a one-third of height portion of said plant so as to shelter said at least a one-third of height portion of said plant.
- 5 66. A plant punch apparatus as described in claim 64 wherein said plant punch body establishes an inner spatial void that is sized to at least partially contain said at least a one-third of height portion of said plant while said downward plant punch force application surface displaces said plant.
- 10 67. A plant punch apparatus as described in claim 64 wherein said downward plant punch force application surface, upon being positioned horizontally about said plant growth medium emerging plant structure, is established less than 360 degrees about said plant growth medium emerging plant structure to form at least one gap around said plant growth medium emerging plant structure.
- 15 68. A plant punch apparatus as described in claim 64 wherein said downward plant punch force application surface, upon being positioned horizontally about said plant growth medium emerging plant structure, is established at least 180 degrees about said plant growth medium emerging plant structure .
- 20 69. A plant punch apparatus as described in claim 68 wherein said downward plant punch force application surface, upon being positioned horizontally about said plant growth medium emerging plant structure, is established less than 360 degrees about said plant growth medium emerging plant structure to form at least one gap around said plant growth medium emerging plant structure.
- 25 70. A plant punch apparatus as described in claim 69 where said at least one gap comprises one gap that allows for lateral access of said downward plant punch force application surface around at least a portion of said plant.
- 30 71. A plant punch apparatus as described in claim 70 wherein said at least a portion of said plant is said plant growth medium emerging plant structure.

72. A plant punch apparatus as described in claim 70 wherein a shape in a horizontal plane of said downward plant punch force application surface is selected from the shapes consisting of: partial annular and partial polygonal.

5

73. A plant punch apparatus as described in claim 64 wherein said plant growth medium emerging plant structure is single-stemmed.

74. A plant punch apparatus as described in claim 64 wherein said at least a one-third of height portion of said plant is portion selected from the group of: a lower one-third, a lower one half, and a lower two-thirds.

10

75. A plant punch apparatus as described in claim 64 wherein plant punch body and said plant punch head each have a perimeter gap that opens to an inner spatial void.

15

76. A plant punch apparatus as described in claim 75 wherein said at perimeter gap of each of said plant punch body and said plant punch head is adapted so that a portion of a plant to be punched can be passed through said perimeter gap of each of said plant punch body and said plant punch head.

20

77. A plant punch apparatus as described in claim 64 wherein said plant punch body comprises a first portion that is contiguous with said plant punch head .

78. A plant punch apparatus as described in claim 77 wherein said first portion of said plant punch body has a horizontal cross section shape that substantially mimics the horizontal cross section shape of said downward plant punch force application surface.

25

79. A plant punch apparatus as described in claim 78 wherein said first portion of said plant punch body has a horizontal cross section size that substantially mimics the horizontal cross section size of said downward plant punch force application surface.

30

80. A plant punch apparatus as described in claim 78 wherein said first portion of said plant punch body is selected from the group of: that portion that is immediately above said downward plant punch force application surface, at least a lower one-third, at least a lower one half, and at least a lower two-thirds.
- 5
81. A plant punch apparatus as described in claim 64 wherein said horizontal cross section shape of said downward plant punch force application surface is unbroken.
82. A plant punch apparatus as described in claim 64 wherein said horizontal cross section shape of said downward plant punch force application surface has at least one gap.
- 10
83. A plant punch apparatus as described in claim 82 wherein said at least one gap comprises one gap that allows for lateral access of said downward plant punch force application surface around at least a portion of said plant.
- 15
84. A plant punch apparatus as described in claim 83 wherein said at least one gap comprises one gap that allows for lateral access of said downward plant punch force application surface to position around said plant growth medium emerging plant structure
- 20
85. A plant punch apparatus as described in claim 83 wherein said first portion of said plant punch body establishes a vertical, slot-like opening above said one gap, and said vertical, slot-like opening opens to said inner spatial void within said plant punch body.
- 25
86. A plant punch apparatus as described in claim 85 wherein said first portion is selected from the group consisting of: at least a lower one-third, at least a lower one-half, and at least a lower two thirds.
- 30
87. A plant punch apparatus as described in claim 85 wherein said inner spatial void is sized so as to contain vegetative parts of said plant while it is being punched by said plant punch head.

88. A plant punch apparatus as described in claim 85 wherein said inner spatial void tapers with an increase in height of said plant punch body.
- 5 89. A plant punch apparatus as described in claim 85 wherein said vertical, slot-like opening established by said plant punch body tapers with an increase in height of said plant punch body.
90. A plant punch apparatus as described in claim 85 wherein said vertical, slot-like
10 opening has an upper end and said inner spatial void has an upper end.
91. A plant punch apparatus as described in claim 90 wherein said upper end of said vertical, slot-like opening and said upper end of said inner spatial void are at substantially the same height.
- 15 92. A plant punch apparatus as described in claim 90 wherein said upper end of said vertical, slot-like opening is higher than said upper end of said inner spatial void.
93. A plant punch apparatus as described in claim 64 wherein said plant punch body has a
20 roughly conical profile from at least one perspective.
94. A plant punch apparatus as described in claim 64 wherein said plant punch body has a roughly frusto-conical profile from at least one perspective.
- 25 95. A plant punch apparatus as described in claim 64 wherein said inner spatial void is closed at the top and open at the bottom.
96. A plant punch apparatus as described in claim 64 wherein said plant punch body has vertical, slot-like opening that is in fluidic communication with said inner spatial void.

97. A plant punch apparatus as described in claim 64 further comprising a downward force transmission element that can transmit a force intended to displace said plant during said plant punch event to said downward plant punch force application surface.

5 98. A plant punch apparatus as described in claim 64 further comprising said plant to be punched.

99 A plant punch apparatus as described in claim 64 further comprising additional plants to be punched by additional plant punch heads.

10

100. A plant punch method, comprising the steps of:

- forcing a downward plant punch force application surface of a plant punch head against an upper surface of plant growth medium in which a plant to be punched is established without contacting said downward plant punch force application surface with a plant growth medium emerging plant structure,

15

wherein said plant growth medium emerging plant structure is that vegetative structure of said plant that emerges from said plant growth medium and supports upper vegetative portions of said plant,

20

and further comprising the steps of:

- punching said plant upon downwardly moving said downward plant punch force application surface during a plant punch, and

25

- sheltering at least a one-third of height portion of said plant during said plant punch while performing said step of punching said plant.

101. A plant punch method as described in claim 100 further comprising the step of establishing a plant punch head substantially about a plant growth medium emerging plant structure of a plant to be punched.

5 102. A plant punch method as described in claim 101 wherein said step of establishing a plant punch head substantially about a plant growth medium emerging plant structure of a plant to be punched comprises the step of moving said plant punch head through a horizontal gap in said plant punch head to a position about said plant growth medium emerging plant structure of said plant.

10

103. A plant punch method as described in claim 100 wherein said step of sheltering at least a one-third of height portion of said plant comprises the step of sheltering a portion selected from: at least a lower one-third, at least a lower two-thirds, at least a lower two-thirds, and substantially all of said plant.

15

104. A plant punch method as described in claim 100 wherein said step of sheltering at least a one-third of height portion of said plant comprises the step of establishing a protective shroud around at least 180 degrees of said at least a one-third of height portion of said plant during said plant punch while performing said step of punching said plant.

20

105. A plant punch method as described in claim 104 wherein the step of establishing a protective shroud around at least 180 degrees of said at least a one-third of height portion of said plant comprises the step of establishing said protective shroud around less than 360 degrees of said at least a one-third of height portion of said plant during said plant punch.

25

106. A plant punch method as described in claim 105 wherein said step of establishing said protective shroud around less than 360 degrees of said at least a one-third of height portion of said plant during said plant punch comprises the step of moving said protective shroud so that at least part of said plant is passed through a gap in said

30

protective shroud, and so that said protective shroud obtains a position around said at least a one-third of height portion of said plant.

107. A plant punch method as described in claim 100 wherein said plant growth medium
5 emerging plant structure is single stemmed.

108. A plant punch apparatus, comprising:

- a plant punch element comprising a plant punch head that itself comprises:

- a downward plant punch force application surface that is adapted so that:

- during a plant punch event, and

- while said plant punch head is displaced downwardly against
15 plant growth medium in which a plant to be punched during said plant punch event is established, and

- while said downward plant punch force application surface is positioned horizontally about a plant growth medium emerging plant structure,

20 said downward plant punch force application surface displaces said plant without contacting said plant growth medium emerging plant structure,

25 wherein said plant growth medium emerging plant structure is that vegetative structure of said plant that emerges from said plant growth medium and supports upper vegetative portions of said plant,

wherein said downward plant punch force application surface has a horizontal cross section shape and size,

30 said plant punch apparatus further comprising:

- a plant punch element movement mechanism that is operable to move said plant punch element through a plurality of spatial points that defines a plant punch element travel path;

5

wherein said plurality of spatial points comprises a first spatial point having a first horizontal distance from a vertical spatial axis defined by a plant emergent point,

10

wherein said plant emergent point is defined by a site at which said plant growth medium emerging plant structure emerges from plant growth medium before it is punched from its container during said plant punch event,

wherein said plant emergent point defines a plant emergent point horizontal plane,

15

wherein said plurality of spatial points further comprises a second spatial point that:

- defines a second horizontal plane that is below said first spatial point and above said plant emergent point horizontal plane, and
- has a second horizontal distance from said vertical spatial axis;

20

wherein said first horizontal distance is greater than said second horizontal distance,

wherein said plant punch element travel path intersects and passes through and below said plant emergent point horizontal plane,

25

wherein said plant punch element travel path has a vertical component at its intersection with said plant emergent point horizontal plane,

30

wherein said plant punch element travel path has a horizontal component at some point from said first spatial point to said second spatial point,

wherein said plant punch head, upon being positioned horizontally about said plant growth medium emerging plant structure, is established less than 360 degrees about said plant growth medium emerging plant structure so as to form at least one plant punch head gap around part of said plant growth medium emerging plant structure, and

wherein said at least one plant punch head gap comprises one plant punch head gap that allows said punch head to be moved laterally to a position around at least a portion of said plant at some point during the travel of said plant punch head along said plant punch head travel path,

said plant punch apparatus further comprising:

- a frame that supports said plant punch element movement mechanism.

109. A plant punch apparatus as described in claim 108 wherein said plant punch element further comprises a plant punch body above said downward plant punch force application surface.

110. A plant punch apparatus as described in claim 109 wherein said plant punch head is established immediately below said plant punch body.

111. A plant punch apparatus as described in claim 109 wherein said plant punch body has a vertical, slot-like gap extending along at least part of its height and above said one of said at least one plant punch head gap.

112. A plant punch apparatus as described in claim 111 wherein said vertical, slot-like gap allows said plant punch body to be moved laterally to a position around at least a portion of said plant at some point during the travel of said plant punch element along said plant punch element travel path.

113. A plant punch apparatus as described in claim 112 wherein said plant punch body obstructively shelters at least a portion of said plant during said plant punch event, wherein said portion is a portion selected from: a lower one-third, a lower one half, and a lower two-thirds.

5

114. A plant punch apparatus as described in claim 109 wherein said plant punch body obstructively shelters at least a portion of said plant during said plant punch event, wherein said portion is a portion selected from: an upper one-third, an upper one half, and an upper two-thirds.

10

115. A plant punch apparatus as described in claim 109 wherein said plant punch body obstructively shelters substantially all of said plant during said plant punch event.

116. A plant punch apparatus as described in claim 108 wherein a shape in a horizontal plane of said downward plant punch force application surface is selected from the shapes consisting of: partial annular and partial polygonal.

15

117. A plant punch apparatus as described in claim 108 wherein there is no part of said downward plant punch force application surface below said one plant punch head gap.

20

118. A plant punch apparatus as described in claim 108 and further comprising a plant punch element gap.

119. A plant punch apparatus as described in claim 118 wherein said plant punch element movement mechanism is manually operable to cause said vertical component of motion.

25

120. A plant punch apparatus as described in claim 118 wherein said plant punch element movement mechanism is operable to electromagnetically cause said vertical component of motion.

30

121. A plant punch apparatus as described in claim 118 wherein said plant punch element movement mechanism is operable to pneumatically cause said vertical component of motion.
- 5 122. A plant punch apparatus as described in claim 108 wherein said plant punch element movement mechanism is operable to cause said horizontal component of motion.
123. A plant punch apparatus as described in claim 122 wherein said plant punch element movement mechanism is manually operable to cause said horizontal component of motion.
- 10
124. A plant punch apparatus as described in claim 122 wherein said plant punch element movement mechanism is operable to electromagnetically cause said horizontal component of motion.
- 15
125. A plant punch apparatus as described in claim 122 wherein said plant punch element movement mechanism is operable to pneumatically cause said horizontal component of motion.
- 20 126. A plant punch apparatus as described in claim 122 wherein said plant punch element movement mechanism automatically causes said horizontal component of motion.
127. A plant punch apparatus as described in claim 126 wherein said plant punch element movement mechanism automatically causes said horizontal component of motion when said plant punch head reaches a certain height.
- 25
128. A plant punch apparatus as described in claim 108 further comprising at least one additional plant punch element that said plant punch element movement mechanism is operable to move to punch at least one additional plant
- 30

129. A plant punch apparatus as described in claim 128 wherein said plant punch element movement mechanism is operable to move said at least one additional plant punch element through at least one additional plant punch element travel path that is horizontally offset from said plant punch element travel path.
- 5 130. A plant punch apparatus as described in claim 108 wherein said plant growth medium emerging plant structure is single stemmed.
- 10 131. A plant punch apparatus as described in claim 108 wherein said plant punch element initiates a horizontal motion at a horizontal motion initiation point located at some point between said first spatial point and said second spatial point and along said plant punch head travel path.
132. A plant punch apparatus as described in claim 131 wherein said horizontal motion initiation point has a horizontal motion initiation height above said plant emergent point horizontal plane, and wherein said horizontal motion initiation height is adjustable.
- 15 133. A plant punch apparatus as described in claim 131 wherein said horizontal motion initiation point has a horizontal motion initiation width that is equal to a horizontal distance of said horizontal motion initiation point from said vertical spatial axis, and wherein said horizontal motion initiation width is adjustable.
- 20 134. A plant punch apparatus as described in claim 108 further comprising said plant to be punched.
- 25 135. A plant punch apparatus as described in claim 134 further comprising additional plants to be punched by additional plant punch elements.
- 30 136. A plant punch method, comprising the steps of:

- moving a first plant punch element that comprises a first plant punch head, downwards from a first position;
- moving said first plant punch element in towards a vertical spatial axis defined by a plant emergent point,

5

wherein said plant emergent point is defined by the site at which a plant growth medium emerging plant structure of a first plant to be punched plant emerges from plant growth medium in which said first plant is established before it is punched from a first container during a plant punch event,

10

- moving said first plant punch element so that at least part of said first plant is passed through a perimeter gap of said first plant punch head;
- establishing said first plant punch head around at least part of said plant growth medium emerging plant structure;
- 15 - punching said first plant out of said first container with said first plant punch element to cause a first plant punch; and
- returning said first plant punch element to said first position.

15

137. A plant punch method as described in claim 136 wherein said first plant punch element further comprises a plant punch body, and wherein said method further comprises the steps of:

20

- moving a first plant punch body downwards from said first position, wherein said first plant punch body is established above said first plant punch head
- 25 - moving said first plant punch body in towards said vertical spatial axis
- moving said first plant punch body so that at least part of said first plant is passed through a said perimeter gap of said first plant punch body
- establishing said first plant punch body around at least part of said plant growth medium emerging plant structure.

25

30

138. A plant punch method as described in claim 137 further comprising the step of protecting with said first plant punch body a height portion of said first plant during said first plant punch, wherein said height portion is a portion selected from: at least a lower one-third, at least a lower one half, at least an lower two-thirds.

5

139. A plant punch method as described in claim 138 wherein said step of protecting with said first plant punch body comprises the step of obstructively sheltering said upper portion of said first plant with said plant punch body.

10 140. A plant punch method as described in claim 137 further comprising the step of protecting with a first plant punch body at least an upper one-third portion of said first plant during said first plant punch.

141. A plant punch method as described in claim 140 wherein said step of protecting with said first plant punch body comprises the step of obstructively sheltering said upper
15 portion of said first plant with said plant punch body.

142. A plant punch method as described in claim 136 further comprising the step of establishing said first plant in a second container after performing the step of punching said first plant out of said first container with said first plant punch element to cause a
20 first plant punch, but before performing said step of returning said first plant punch element to said first position, wherein said second container is larger than said first container and is positioned below said first container.

143. A plant punch method as described in claim 136 further comprising the steps of
25 repeating steps the first five steps listed in claim 1.

144. A plant punch method as described in claim 136 further comprising the step of moving at least one additional plant punch element so that it moves at the same time as said first plant punch element but along a travel path that is horizontally offset from a
30 travel path of said first plant punch element.

145. A plant punch method as described in claim 144 further comprising the step of punching at least one additional plant out of a container in which it is established and into a different container below.
- 5 146. A plant punch method as described in claim 136 wherein moving a first plant punch element downwards from a first position comprises pneumatically moving said first plant punch head.
- 10 147. A plant punch method as described in claim 136 wherein moving a first plant punch element downwards from a first position comprises electromagnetically moving said first plant punch element.
148. A plant punch method as described in claim 136 wherein moving a first plant punch element downwards from a first position comprises manually moving said first plant punch element downwards from said first position.
- 15 149. A plant punch method as described in claim 136 wherein moving said first plant punch element in towards a vertical spatial axis defined by a plant emergent point comprises pneumatically moving said first plant punch head in towards said vertical spatial axis defined by said plant emergent point.
- 20 150. A plant punch method as described in claim 136 wherein moving said first plant punch element in towards a vertical spatial axis defined by a plant emergent point comprises electromagnetically moving said first plant punch element.
- 25 151. A plant punch method as described in claim 136 wherein moving said first plant punch element in towards a vertical spatial axis defined by a plant emergent point comprises manually moving said first plant punch element.
- 30 152. A plant punch method as described in claim 136 wherein moving said first plant punch element in towards a vertical spatial axis defined by a plant emergent point comprises

automatically moving said first plant punch element in towards said vertical spatial axis when said first plant punch element reaches a certain position.

153. A plant punch method as described in claim 136 wherein said plant growth medium
5 emerging plant structure is single stemmed.

154. A plant punch method as described in claim 136 wherein said step of moving said first
plant punch element in towards a vertical spatial axis comprises the step of initiating a
horizontal motion of said first plant punch element at a horizontal motion initiation
10 point.

155. A plant punch method as described in claim 154 wherein said step of initiating a
horizontal motion of said first plant punch element at a horizontal motion initiation
point comprises the step of initiating a horizontal motion of said first plant punch
15 element at a horizontal motion initiation height above a horizontal plane defined by
said plant emergent point, and further comprises the step of adjusting said horizontal
motion initiation height.

156. A plant punch method as described in claim 154 wherein said step of initiating a
horizontal motion of said first plant punch element at a horizontal motion initiation
20 point comprises the step of initiating a horizontal motion of said first plant punch
element at a horizontal motion initiation width that is equal to a horizontal distance of
said horizontal motion initiation point from said vertical spatial axis, and further
comprising the step of adjusting said horizontal motion initiation width.

157. A plant punch apparatus, comprising:
- a plant punch head comprising:
- a downward plant punch force application surface that is adapted so
that:
30 - during a plant punch event, and

- while said plant punch head is displaced downwardly against plant growth medium in which a plant to be punched during said plant punch event is established, and
- while said downward plant punch force application surface is positioned horizontally about a plant growth medium emerging plant structure,
- said downward plant punch force application surface displaces said plant without contacting said plant growth medium emerging plant structure,

wherein said plant punch head has a horizontal cross section shape and size, and

wherein said plant growth medium emerging plant structure is that vegetative structure of said plant that emerges from said plant growth medium and supports upper vegetative portions of said plant,

wherein said plant punch head is unbroken and without a perimeter gap,

wherein said plant punch head horizontally surrounds a spatial void that is internal of said plant punch head when said plant punch apparatus is installed in a plant punch machine,

and wherein said horizontal cross section shape and size is adequate to surround a plant growth medium emerging plant support structure at an initiation of a plant punch event.

158. A plant punch apparatus as described in claim 157 and not comprising a plant punch body.

159. A plant punch apparatus as described in claim 157 wherein said horizontal cross section shape and size is adequate to surround a majority of an upper vegetative portion of said plant.

5 160. A plant punch apparatus as described in claim 157 further comprising a downward force transmission element connected with said plant punch head.

161. A plant punch apparatus as described in claim 157 wherein there is no physical material internal of said plant punch head.

10